

NAI Focus Group

NASA ASTROBIOLOGY INSTITUTE

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The rational search for life beyond Earth requires some concept of the conditions under which life originates and begins to evolve, and of the environmental "fingerprints" of primitive biospheres. This concept must be informed by a solid understanding of the only planet on which life is known to exist - the Earth. Hence, study of life and the environment on the early Earth is a critical component in developing mission plans for astrobiology space missions. This is the underlying rationale of the Mission to Early Earth (MtEE) Focus Group.

Background

The geologic record is increasingly sparse as one examines the condition of the early Earth further back in time. Furthermore, the quality of material easily available is not high - particularly when interest in environmental and biological history leads to a focus on biogeochemical signatures that are not robust against oxidation and other alteration processes at the Earth's surface. From discussions early in the formation of the MtEE Focus Group, a consensus emerged that progress in this new area of "bio-environmental reconstruction" is fundamentally sample limited. This consensus in the community led

directly to the concept that the MtEE Focus Group might be most useful as a means to promote, provide justification for, and identify support for the acquisition and distribution of samples from the Precambrian, with a special focus on deep drilling to acquire pristine sediment samples from the near subsurface (< 1000 m). This activity has the potential to stimulate participation and collaboration from across the Institute, one of the benefits of the NAI focus groups as originally conceived by its Director. In addition, these types of sampling activities have the potential to provide opportunities to test technologies that might prove useful in future Mars exploration. The projects under development by the MtEE Focus Group should, in particular, provide information useful in the development of the Terrestrial Planet Finder mission, by elucidating the history of oxygenic photosynthesis and the oxygenation of the atmosphere.

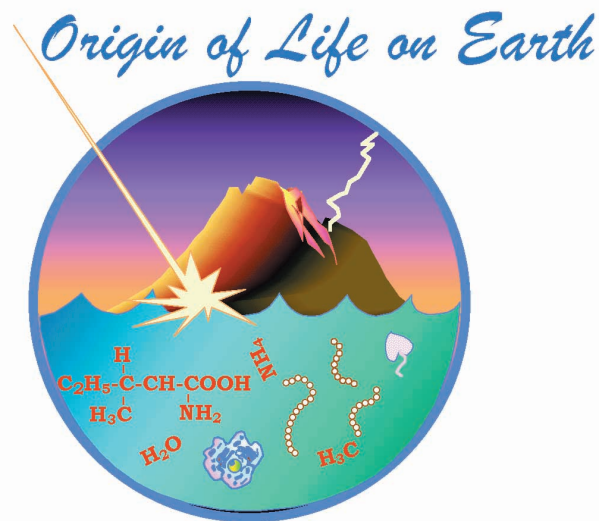
This image of the Earth was obtained by the Galileo spacecraft on Dec. 11, 1990, when the spacecraft was about 1.5 million miles from the Earth. India is near the top, and Australia is to the right of center. The white, sunlit continent of Antarctica is below. Pictur-
esque weather fronts are visible in the South Pacific, lower right.



Recent Activities

With support from the NAI, the first major activity of the MtEE Focus Group was to organize an Australian field excursion for the summer of 2001 to Western Australia. This general area of Western Australia is one of the few places on Earth with well-preserved sediments (including biosignatures) from the Archean, i.e., the period before 2.5 billion years ago - the first half of Earth history. As a result, a number of exciting, astrobiologically-relevant publications have emerged recently as a result of research into this region. One project organized by the MtEE Focus Group traveled to the Jack Hills area under the guidance of Steve Mojzsis (University of Colorado Team). The primary goal of this effort was to become familiar with the local stratigraphy and astrobiologically-relevant localities in order to develop concepts for a pilot astrobiology drilling project. A second team visited the Pilbara, under the guidance of Roger Buick (University of Washington Team). The primary goal of this group was to obtain samples from the earliest geologic record. Both of these excursions were scheduled to begin after the NAI-sponsored sessions in the Earth System Processes Conference in Edinburgh in late June, and to flow into the Astrobiology Workshop at Macquarie University scheduled for mid-July. The latter meeting was sponsored by the Australian Centre for Astrobiology

Terrestrial life is the only form of life that we know, and it appears to have arisen from a common ancestor. How and where did this remarkable event occur? The Mission to Early Earth Focus Group hopes to understand the origin of life on our planet.



(ACA), an NAI Affiliate Member. Coordination for all of these events was possible by collaboration with Malcolm Walter (Macquarie University) who is the Lead at the ACA.



Artist conception of early Earth. The MtEE Focus Group hopes to improve our understanding of the emergence and early evolution of life, particularly as it relates to the environment of the early Earth.